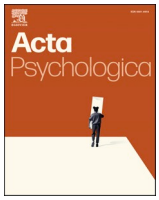
Acta Psychologica 222 (2022) 103481

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy



Editorial

Top-down social modulation of perception-action coupling

Perception-action coupling is a fundamental process that involves the processing of other people's actions and the integration of those actions into one's own motor planning. It is thought to be at the basis of important social skills such as biological motion perception (Blake & Shiffrar, 2007), imitation (Brass & Heyes, 2005; Cracco, Bardi, et al., 2018), and joint action (Sebanz et al., 2006). Indeed, supporting such a social function, a key finding in the literature is that perception-action coupling depends on social factors related to the self (e.g., affiliation motives; Genschow & Schindler, 2016), the other (e.g., social group; Gleibs et al., 2016), and the context (e.g., cooperation or competition; Glover & Dixon, 2017).

However, a number of recent, well-powered studies suggest that the influence of social factors on perception-action coupling may have been exaggerated (e.g., Cracco, Bardi, et al., 2018; Darda et al., 2020; Genschow et al., 2021; Giesen et al., 2021; Newey et al., 2019). More generally, a limiting factor of the existing research is that it has often used relatively modest sample sizes to detect what are likely subtle effects. Therefore, this special issue aimed to collect well-designed and -powered research on the social modulation of perception-action coupling to better understand which social variables do and which social variables do not influence how we represent other people's actions. To achieve this aim, all studies were required to justify why their sample size was appropriate to answer their research question.

The special issue includes 16 papers studying a large variety of social factors and various measures of perception-action coupling (Carr et al., 2021; Ciardo et al., 2021; Farmer et al., 2021; Forbes et al., 2021; Galang & Obhi, 2020; Giesen & Frings, 2021; Hansen et al., 2020; Kastendieck et al., 2021; Khemka et al., 2021; Macpherson et al., 2020; Peng et al., 2021; Van der Weiden et al., 2021; Weller et al., 2020; Wessler & Hansen, 2021; Westfal et al., 2021). In addition, it also includes 2 papers studying the inverse relationship, namely the consequences of being imitated on social functioning (Bukowski et al., 2021; Rauchbauer et al., 2020), and one review paper discussing the challenges and opportunities for research studying the social modulation of perception-action coupling (Ramsey & Ward, 2020). Although most contributions came from researchers based in Europe (i.e., Germany, Austria, UK, Belgium, and Italy), there were also contributions from research groups in the USA, Canada, and Australia. Of the 17 empirical studies included in the special issue, 4 were (partly) preregistered (Galang & Obhi, 2020; Kastendieck et al., 2021; Macpherson et al., 2020; Westfal et al., 2021) and 12 made their data and/or materials openly accessible (Bukowski et al., 2021; Carr et al., 2021; Farmer et al., 2021; Forbes et al., 2021; Giesen & Frings, 2021; Hansen et al., 2020; Kastendieck et al., 2021; Macpherson et al., 2020; Rauchbauer et al., 2020; Van der Weiden et al., 2021; Weller et al., 2020; Westfal et al., 2021). As requested, all of the empirical studies included in the special issue justified their sample size.

Two papers in the special issue studied the influence of social variables on action perception. Interestingly, both these papers investigated how social anxiety influences social perception. Peng et al. (2021) replicated the "facing-the-viewer-bias" (i.e., the finding that people tend to perceive bistable point-light walkers as walking towards them) but in contrast to previous reports (Heenan & Troje, 2015; Van de Cruys et al., 2013) found no correlation between social anxiety (nor autism traits) and this bias. In a preregistered study, Macpherson et al. (2020) successfully replicated the finding by Lumsden et al. (2012) that people perceive the actions of dissimilar dyads to be less coordinated than the actions of similar dyads. Moreover, extending this work, they also showed that the level of perceived coordination is correlated with social anxiety.

A further 13 studies tested the influence of social factors on imitation. Six of those studies used the imitation-inhibition paradigm (Brass et al., 2000; Stürmer et al., 2000), a well-known cognitive task to measure automatic imitation (Cracco, Bardi, et al., 2018; Heyes, 2011). The first two studies took a correlational approach. Specifically, based on evidence that automatic imitation is stronger for intentional actions (Liepelt et al., 2008) and that people who believe in free will are more likely to perceive behavior as being intentional (Genschow, Rigoni, & Brass, 2019), Westfal et al. (2021) tested the relationship between belief in free will and automatic imitation, but found no evidence for such a correlation. Similarly, Galang and Obhi (2020) found that automatic imitation was not correlated with either empathy or prosocial behavior, consistent with previous evidence that automatic imitation is not correlated with social traits (Butler et al., 2015; Cracco, Bardi, et al., 2018; Darda et al., 2020; Genschow et al., 2017).

The other 4 studies used an experimental approach. Farmer et al. (2021) conducted five experiments following up on mixed evidence that priming participants with emotional expressions can influence automatic imitation (e.g., Butler et al., 2016; Rauchbauer et al., 2016), but found no evidence for such an effect, not even when the observed movements had a social or affective meaning. Carr et al. (2021) sought to replicate previous evidence that eye contact increases automatic imitation (e.g., Wang et al., 2011), by measuring not only automatic imitation but also effector priming (i.e., the finding that highlighting a specific stimulus finger primes a response with that same finger, even if the stimulus finger does not make a movement). However, in contrast to earlier work, they found that automatic imitation was not influenced by eye gaze. Effector priming, on the other hand, was influenced by eye gaze, but in the opposite direction: it was stronger following averted gaze than following direct gaze. Moreover, this latter effect was also not specific to eye gaze, as similar effects were obtained when direct or

https://doi.org/10.1016/j.actpsy.2021.103481

Available online 29 December 2021

averted arrows were used instead of eye stimuli. Khemka et al. (2021) aimed to replicate and extend the finding that sitting in front of a mirror increases self-focus and as a consequence reduces automatic imitation (Spengler et al., 2010). However, in contrast to earlier reports, they found no evidence for an effect of the manipulation on either self-focus or automatic imitation. Finally, Rauchbauer et al. (2020) tested the hypothesis that being imitated would increase automatic imitation, based on evidence that being imitated increases self-other overlap (e.g., De Coster et al., 2013) and that self-other overlap is at the basis of automatic imitation (Prinz, 1997). Interestingly, however, they found the opposite result.

In addition to the 6 studies using the imitation-inhibition task, 5 studies also used different approaches to measure imitation. Hansen et al. (2020) studied the extent to which participants imitated movements (i.e., proximal imitation) that interfered with their task goal and found increased imitation when participants were primed to have a psychologically proximal or concrete mindset, consistent with previous evidence that psychological distance can influence imitation (Genschow, Hansen, et al., 2019). In a series of experiments on gaze following, Ciardo et al. (2021) further provided evidence for an interactive influence of social cues such as age, sex, and social status. Finally, three last studies looked at facial mimicry (Forbes et al., 2021; Kastendieck et al., 2021; Wessler & Hansen, 2021). Similar to earlier work using the imitation-inhibition task (Cracco, Genschow, et al., 2018; but see also Farmer et al., 2021), Kastendieck et al. (2021) found that mimicry of happy and sad expressions was reduced when the expressions were inappropriate in the social context (e.g., smiling at a funeral). Forbes et al. (2021) further found preliminary evidence that mimicry of happy expressions was stronger for self-relevant faces, but found no effect of reward, in contrast to previous studies (Sims et al., 2012). Finally, Wessler and Hansen (2021) found that facial mimicry was equally strong for real and cartoon faces, suggesting that it is robust to social degradation of the stimuli.

Finally, the special issue also includes two studies that used imitation not as the dependent measure but as a manipulation (Bukowski et al., 2021; Weller et al., 2020). Bukowski et al. (2021) showed in two experiments that being imitated had no influence on self-other distinction, in contrast to previous reports (e.g., Santiesteban et al., 2012), but did have an influence on self-salience. Weller et al. (2020) further found that anticipating being imitated facilitated task-related responses (see also Kunde et al., 2018), but they found no evidence for their hypothesis that this effect should be influenced by social group membership.

The last two empirical studies included in this special issue focused on joint action (Giesen & Frings, 2021; Van der Weiden et al., 2021). Using the joint Simon task, Van der Weiden et al. (2021) investigated whether feelings of power, manipulated by putting participants in an elevated or lower seating position, influenced co-representation of a partner's task. In line with their hypothesis, they found reduced co-representation when participants were seated in an elevated position, but further analyses could not confirm that this effect was indeed the result of differences in perceived power. Giesen and Frings (2021) instead looked at the influence of perspective and social group manipulations on the retrieval of observationally acquired stimulus-response bindings in a video-based task, but found no effect of either variable, in contrast with some of their earlier research using an interactive task (e.g., Giesen et al., 2014).

Given the large variability among the studies included in this special issue, it is difficult to summarize its result in just a couple of sentences. Nevertheless, despite this variability, two broader points do emerge. A first point is that experimentally manipulating social factors is more likely to be successful than looking at correlations with social traits. Indeed, of the four studies investigating such correlations (Galang & Obhi, 2020; Macpherson et al., 2020; Peng et al., 2021; Westfal et al., 2021), only one found a significant relationship (Macpherson et al., 2020). A possible methodological explanation for this finding is that perception-action coupling is typically measured using cognitive tasks that were developed to minimize interindividual differences (Hedge et al., 2017). From this perspective, a better approach is, thus, to use experimental manipulations. However, even though experimental approaches were overall more successful in this special issue, a substantial number of these studies nevertheless failed to replicate previous results, despite often using considerably larger samples than the original research. Although the reason for each of these replication failures is unknown, the broader pattern indicates that social effects on perception-action coupling are likely to be rather small and therefore that either preregistered, well-powered research or independent replications are needed before we can conclude that an effect exists.

A second point is that there are a number of factors that may increase the probability of identifying social effects. First, the results of Giesen et al. (2021) suggest that interactions with actual people may be more effective than showing people on a computer screen. Although other results from this special issue indicate that real-life interaction is neither a necessary (Ciardo et al., 2021; Forbes et al., 2021; Hansen et al., 2020; Kastendieck et al., 2021; Macpherson et al., 2020; Van der Weiden et al., 2021; Wessler & Hansen, 2021) nor a sufficient condition (Weller et al., 2020) to find social effects, it nevertheless suggests that researchers should try to develop tasks and stimuli that are as realistic as possible. Second, the results of Ciardo et al. (2021) highlight the importance of manipulating multiple social factors together, consistent with computational models of person perception arguing that how we perceive other people and their actions depends on continuous interactions between various social cues (Freeman & Ambady, 2011). From such a perspective, manipulating multiple cues simultaneously may be necessary to fully understand the influence of social variables on perception-action coupling.

Where do we go from here? Ramsey and Ward (2020) provide an insightful discussion on this question in their review paper. They propose to leave behind broad distinctions such as those between "bottom-up" and "top-down" and between "social" and "non-social" and argue that a more fruitful approach is to instead develop precise and well-defined hypotheses about specific variables that can be framed in broader frameworks from the semantic cognition and other literatures, such as the person perception model discussed above (Freeman & Ambady, 2011). Like Ramsey and Ward (2020), we believe that adopting such an approach is likely to help the field in building a cumulative science of social modulation. Indeed, it is clear from the results of this special issue that both the hypothesis that "*social variables influence perception-coupling*" and the hypothesis that "*social variables do not influence perception-coupling*" are false. Instead, whether a specific variable has an influence likely depends more on the specific variable than on whether it is social or not. On that view, bringing the field forward will require a step away from theories that make broad claims about social modulation in a general sense and a step towards more fine-grained theories that are tailored to the specific variable of interest, although such theories might still be embedded within a broader framework, as Ramsey and Ward (2020) outline in detail in their paper.

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